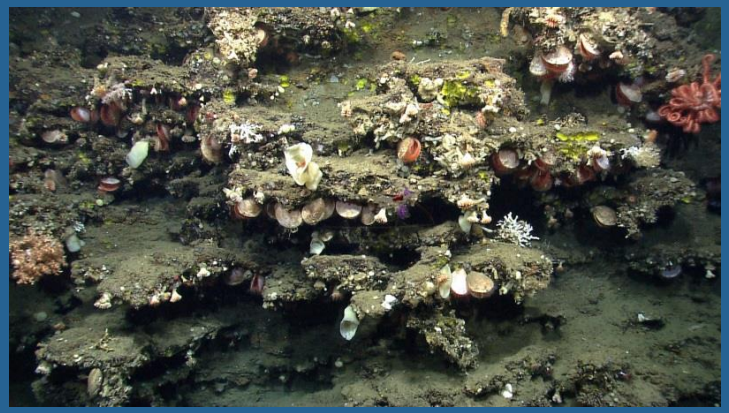
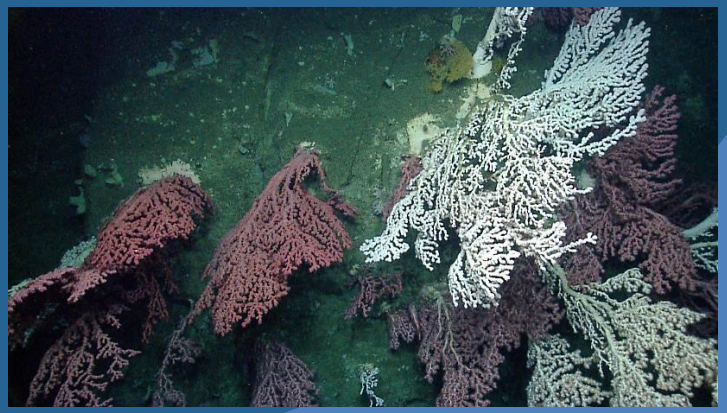
A Tale of Two Canyons: ROV Surveys Highlight Differences in Species Composition and Abundances of Deep-Sea Corals in Nygren and Heezen Canyons, Western North Atlantic

NOAA FISHERIES

Office of Science and Technology





Martha S. Nizinski and Andrea M. Quattrini

Deep-Sea Corals

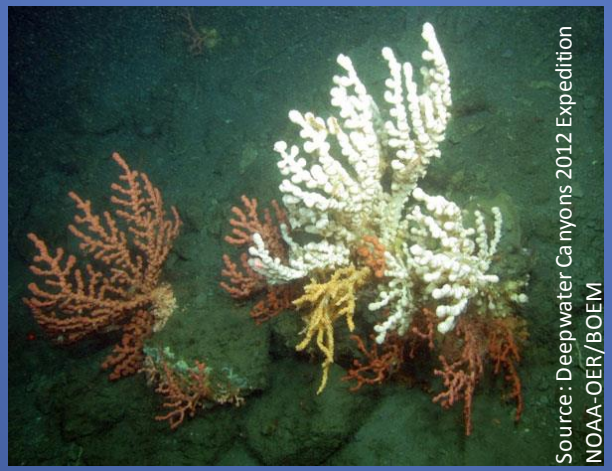
- Deep water (>50 m)
- Cold temperatures
- Strong currents
- Azooxanthellate

Source: Deepwater Canyons 2012 Expedition NOAA-OER/BOEM

Scleractinians
(stony corals)

Source: Nizinski et al. NOAA/NMFS, WHOI 2014

Antipatharians
(black corals)



Source: Deepwater Canyons 2012 Expedition NOAA-OER/BOEM

Alcyonaceans
(octocorals, soft corals)

Source: R. Langton

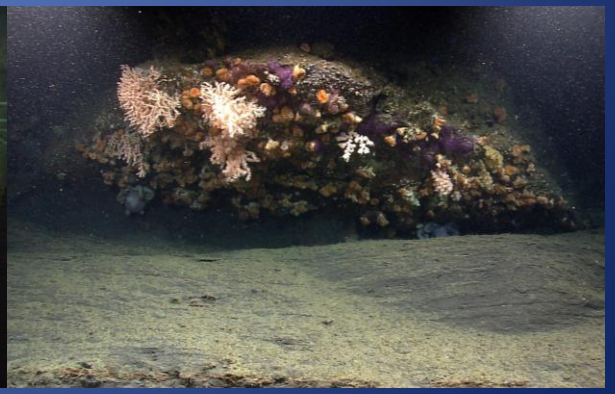
Pennatulaceans
(sea pens)

Diverse and Valuable Resource

- Important providers of habitat structure for fishes and invertebrates
  - Refuge
  - Aggregation for spawning and feeding
- Conservation concern
  - Slow growth rates
  - Vulnerability to bottom disturbance

- Deep-sea corals are diverse.
  - Approximately 3500 species worldwide
  - 680 in US waters
- Deep coral habitats may far exceed shallow coral habitats in overall area.
- Deep-sea coral habitats support valuable resources and have potential for many new discoveries.



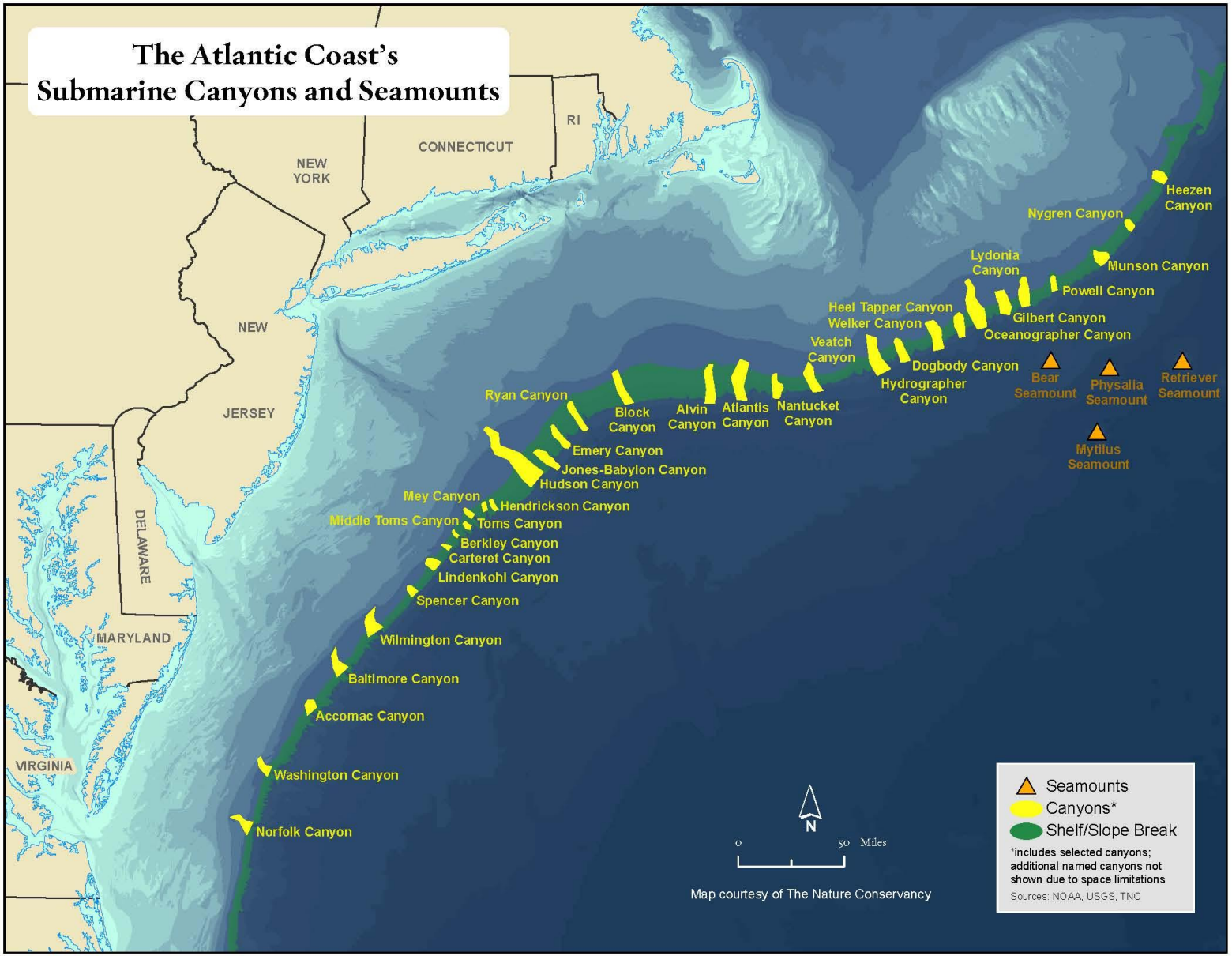


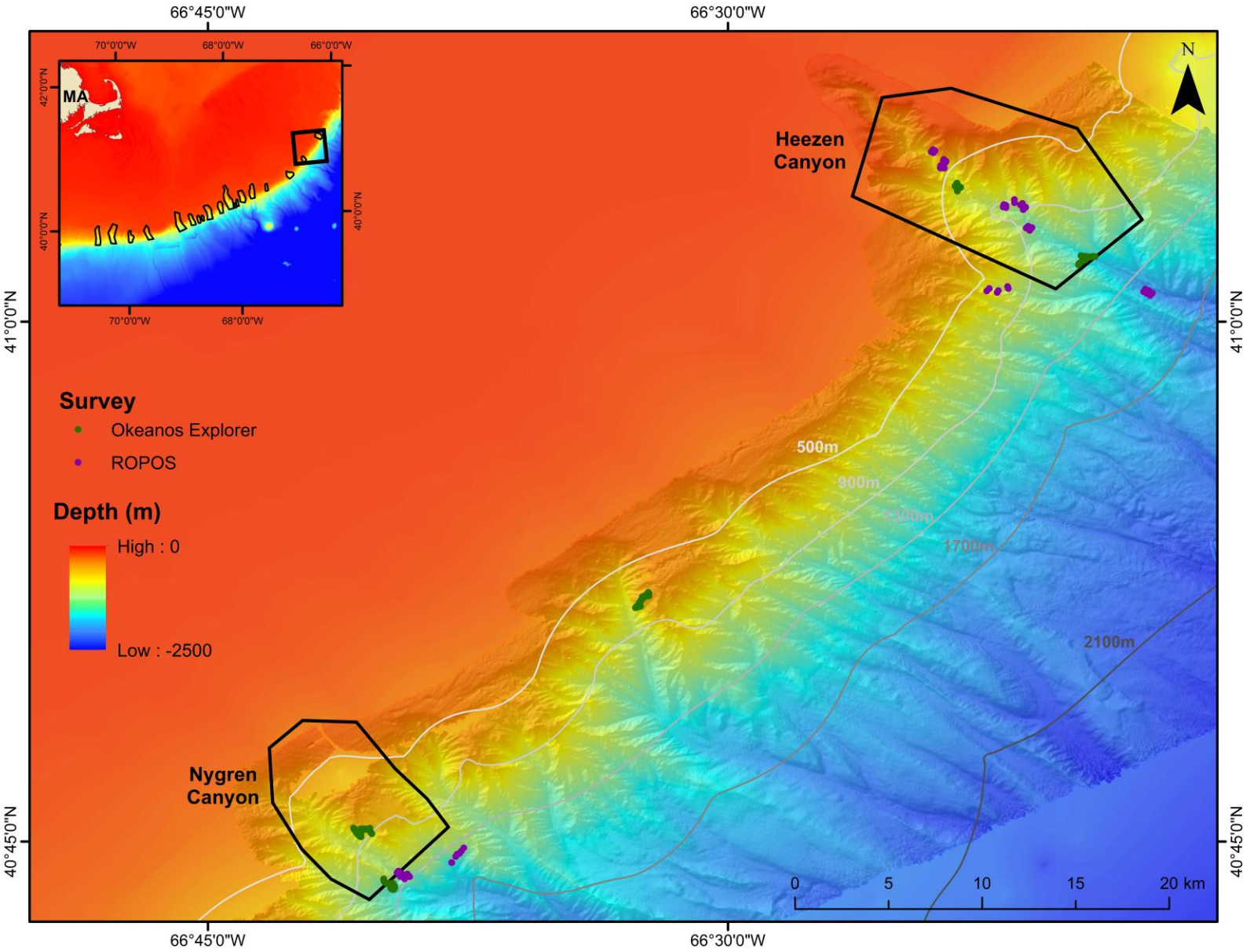
We can't manage what we don't know

Northeast Regional Deep-Sea Coral Initiative

Provide fisheries management councils with much needed contemporary data to support management decisions including:

- What species of corals occur in the region?
- Where do the corals occur?
- How are they distributed?
- How abundant are corals in the region?
- How diverse is the coral assemblage?

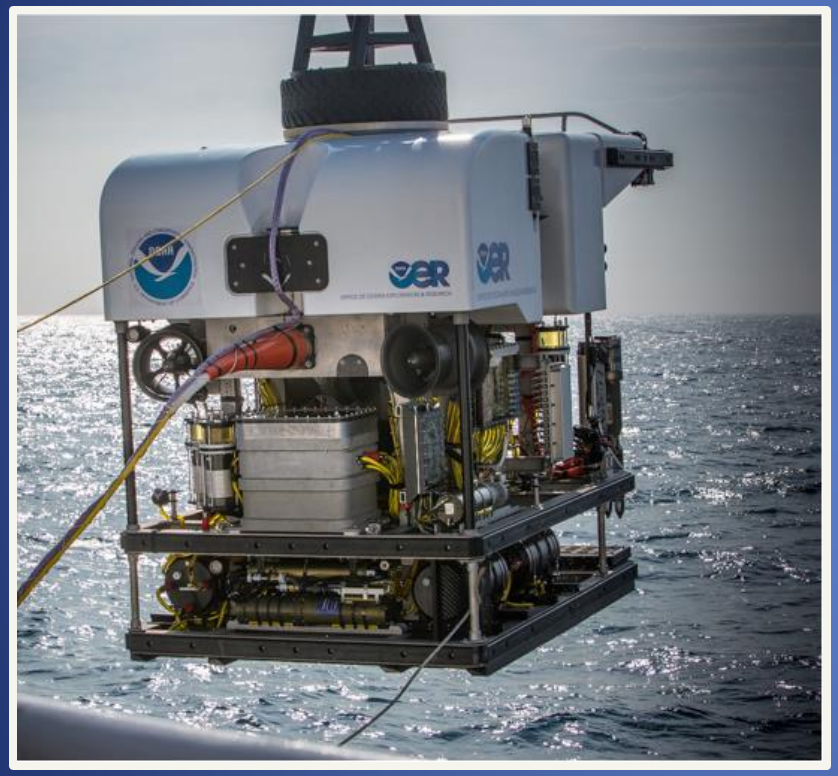

The Atlantic Coast's
Submarine Canyons and Seamounts
RI
CONNECTICUT
NEW YORK
NEW JERSEY
DELAWARE
MARYLAND
VIRGINIA
Heezen Canyon
Nygren Canyon
Lydonia Canyon
Munson Canyon
Powell Canyon
Heel Tapper Canyon
Welker Canyon
Gilbert Canyon
Oceanographer Canyon
Veatch Canyon
Dogbody Canyon
Hydrographer Canyon
Bear Seamount
Physalia Seamount
Retriever Seamount
Mytilus Seamount
Ryan Canyon
Block Canyon
Alvin Canyon
Atlantis Canyon
Nantucket Canyon
Emery Canyon
Jones-Babylon Canyon
Hudson Canyon
Mey Canyon
Hendrickson Canyon
Middle Toms Canyon
Toms Canyon
Berkley Canyon
Carteret Canyon
Lindenkohl Canyon
Spencer Canyon
Wilmington Canyon
Baltimore Canyon
Accomac Canyon
Washington Canyon
Norfolk Canyon
N
0
50 Miles
Map courtesy of The Nature Conservancy
Seamounts
Canyons*
Shelf/Slope Break
*includes selected canyons; additional named canyons not shown due to space limitations
Sources: NOAA, USGS, TNC


66°45'0"W
66°30'0"W
41°0'0"N
40°45'0"N
70°0'0"W
68°0'0"W
66°0'0"W
42°0'0"N
40°0'0"N
MA
N
Heezen Canyon
Nygren Canyon
Survey
Okeanos Explorer
ROPOS
Depth (m)
High : 0
Low : -2500
500m
900m
1300m
1700m
2100m
0
5
10
15
20 km

Objectives

- Our data suggest each canyon has its own geological and biological signature
- How similar are coral assemblages in adjacent canyons in the Northwest Atlantic?
  - Coral diversity and abundance
  - Microhabitat diversity
  - Geology

Data Collection

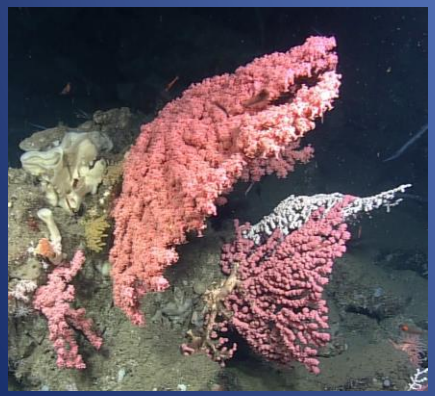


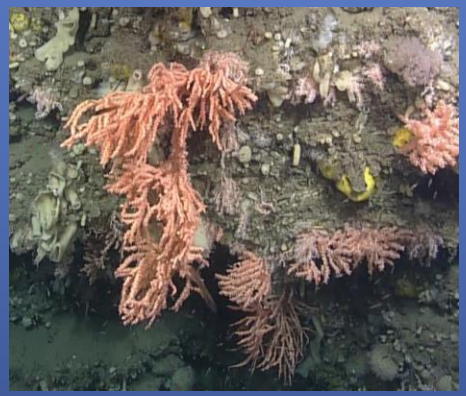
Deep Discoverer (NOAA)

ROPOS (CSSF)

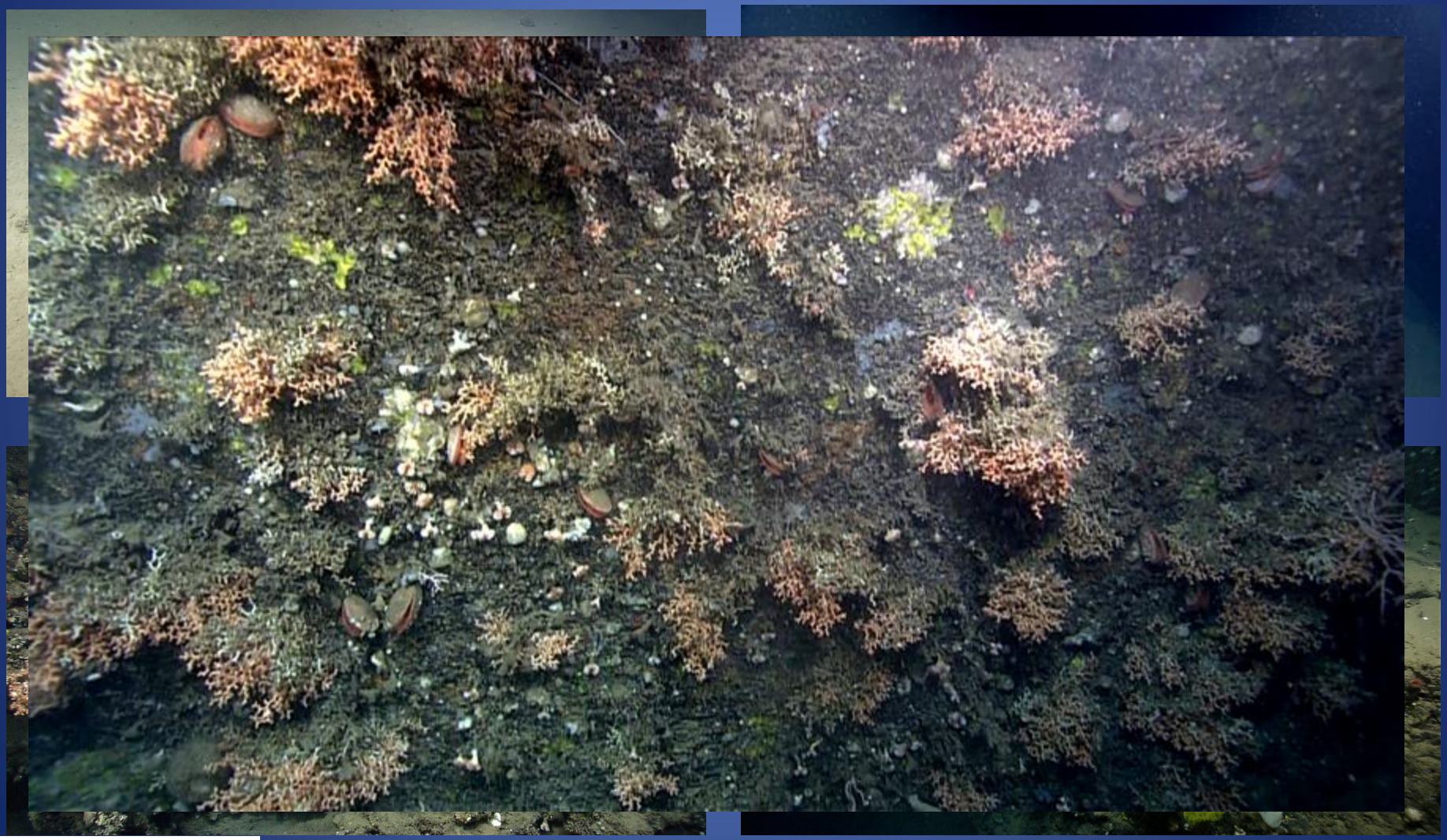
Methods

- ROV transects selected based on bathymetry, slope, and model predictions
- Corals, identified to lowest possible taxon, recorded along entire transect
- Habitat type recorded at each coral location
- Abundances for three major coral taxa estimated from minute-long video segments

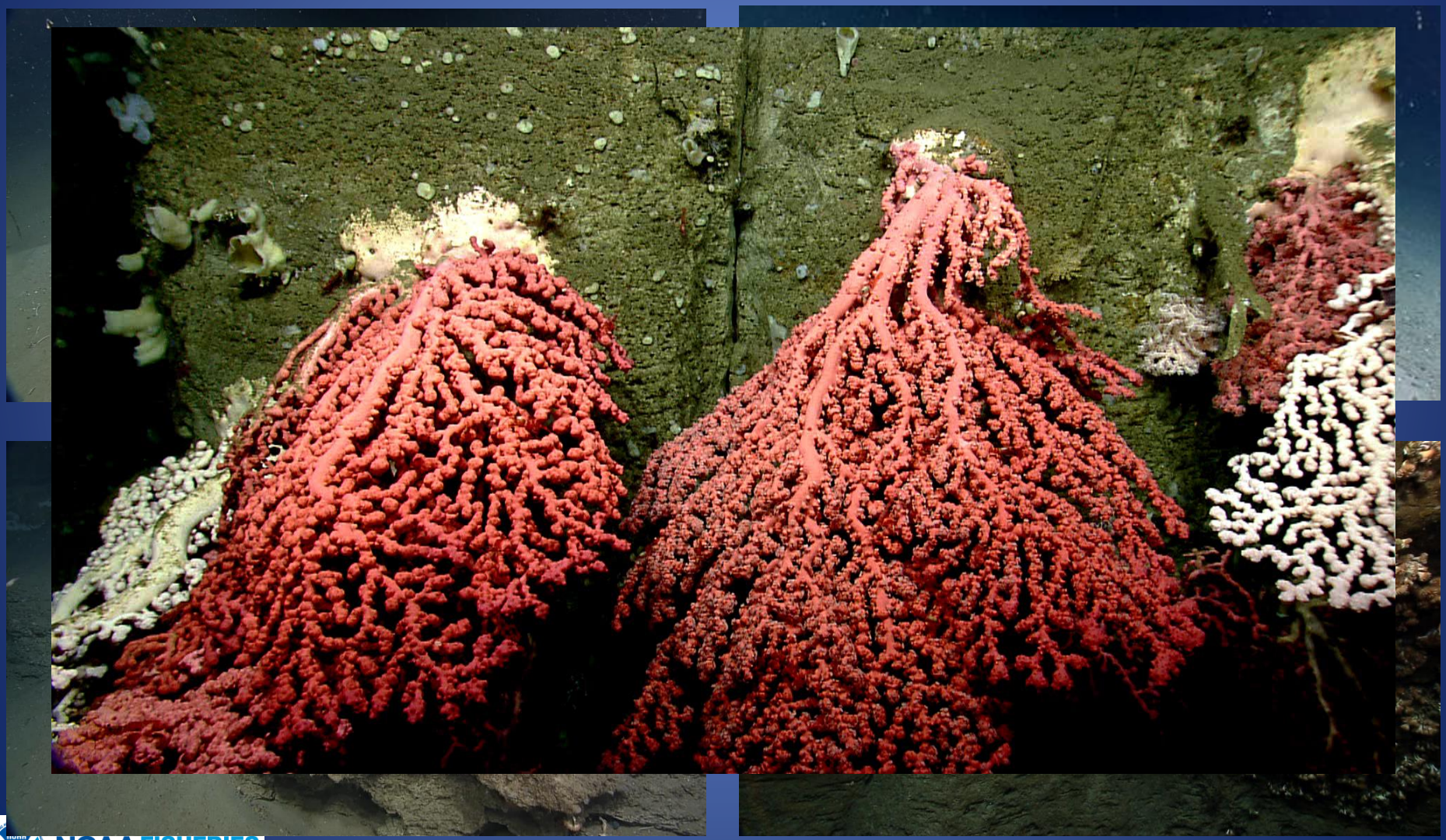




Nygren Canyon



Heezen Canyon



Species Richness and Diversity

Nygren Canyon

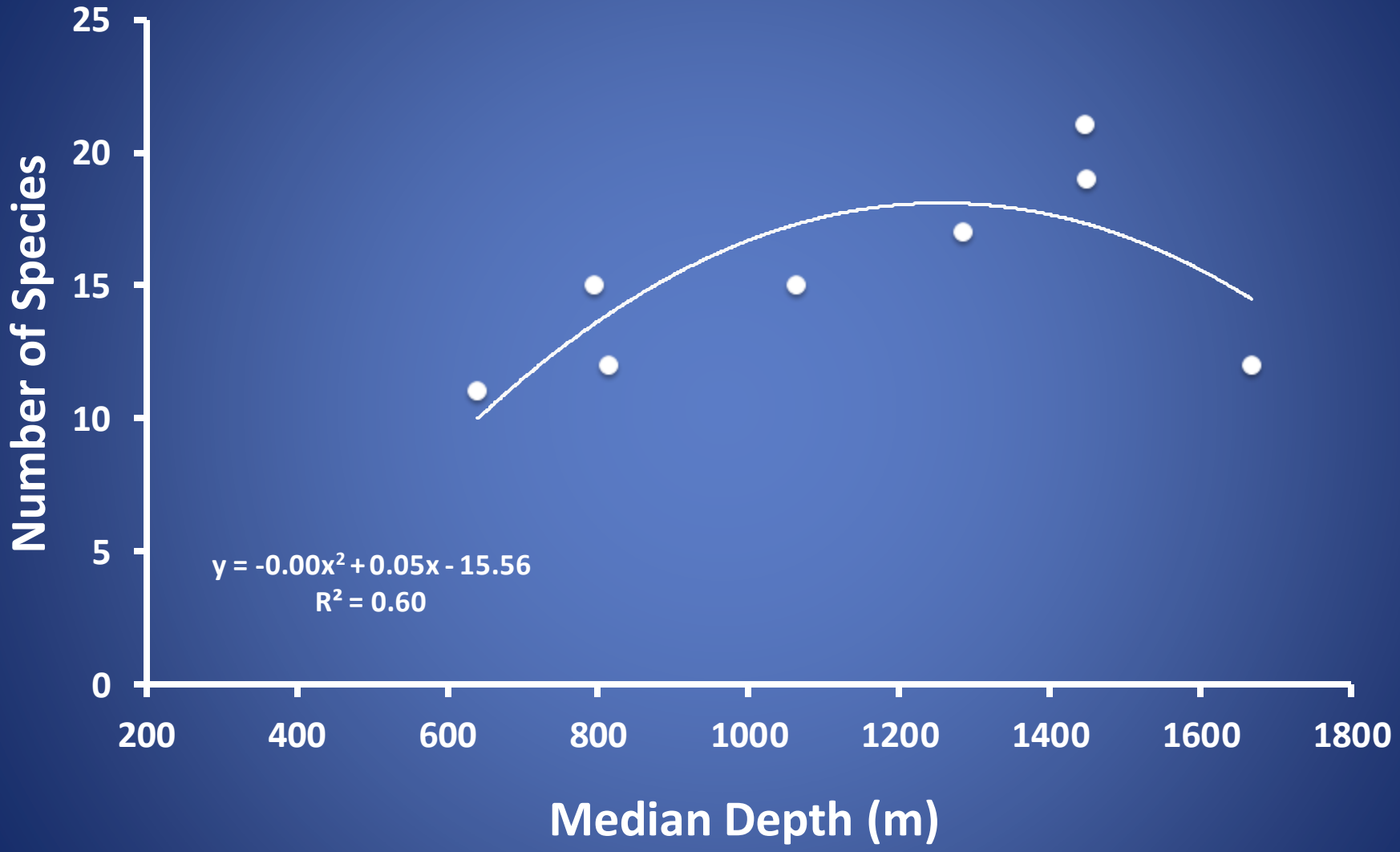
Depth	Richness	Diversity
678-914	15	5.2
1166-1405	17	5.6
1292-1606	21	6.6
1310-1590	19	6.1

Heezen Canyon

Depth	Richness	Diversity
495-786	11	4.2
703-926	12	4.4
955-1175	15	5.2
1615-1723	12	4.4

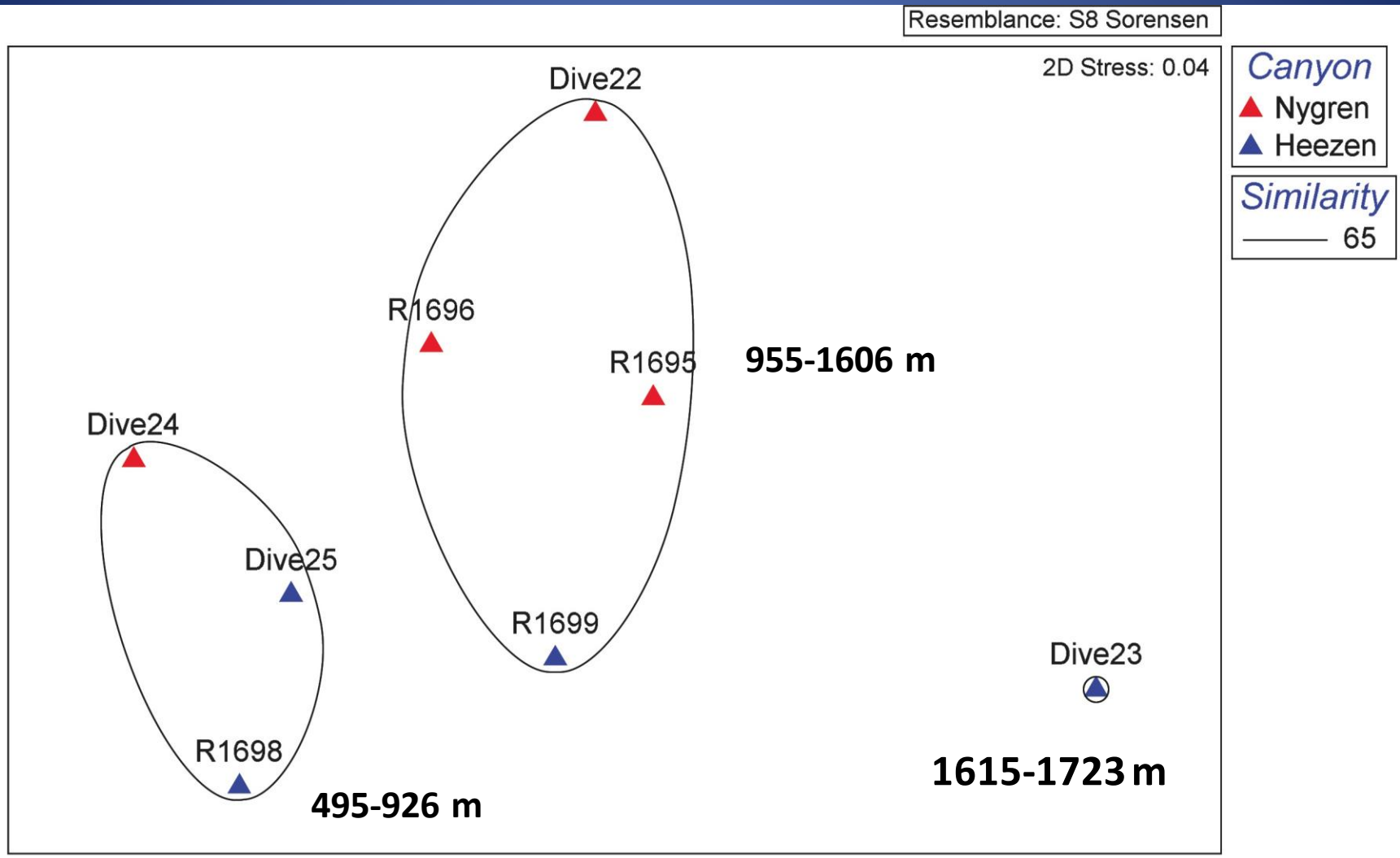
Nygren Canyon > Heezen Canyon

Coral Species Richness Peaks at Mid-Slope Depths

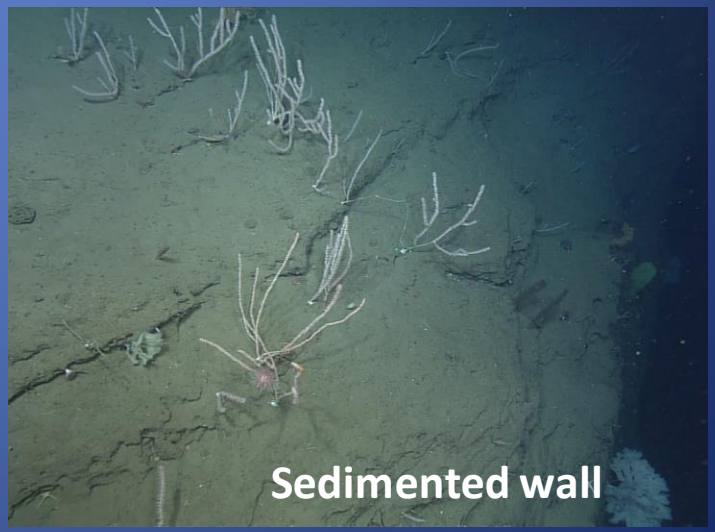


Coral Assemblages Differ with Depth

SIMPROF <0.05



Coral/Habitat Associations



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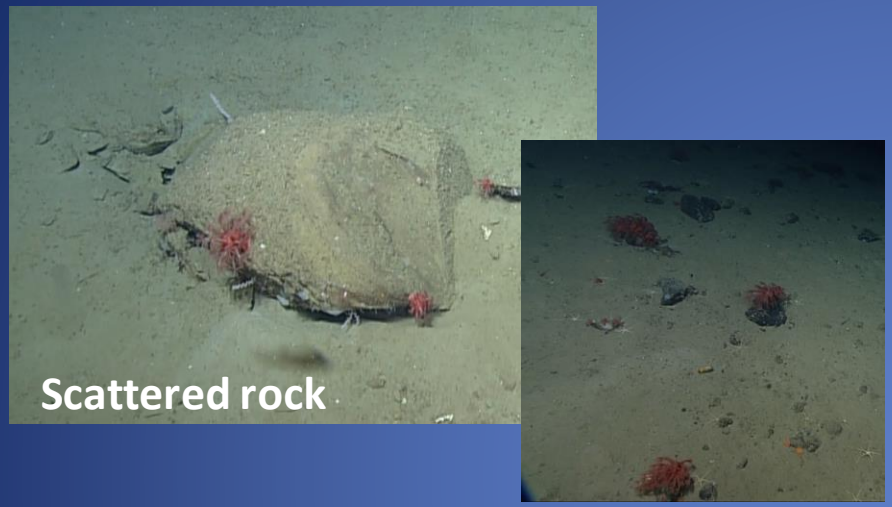
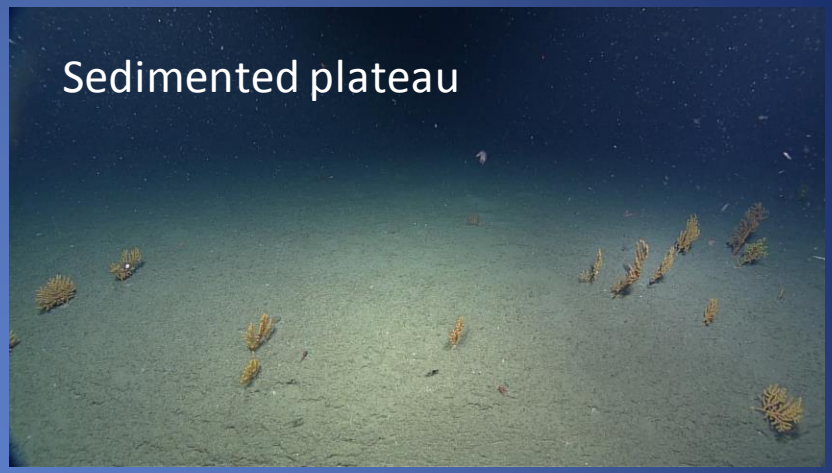
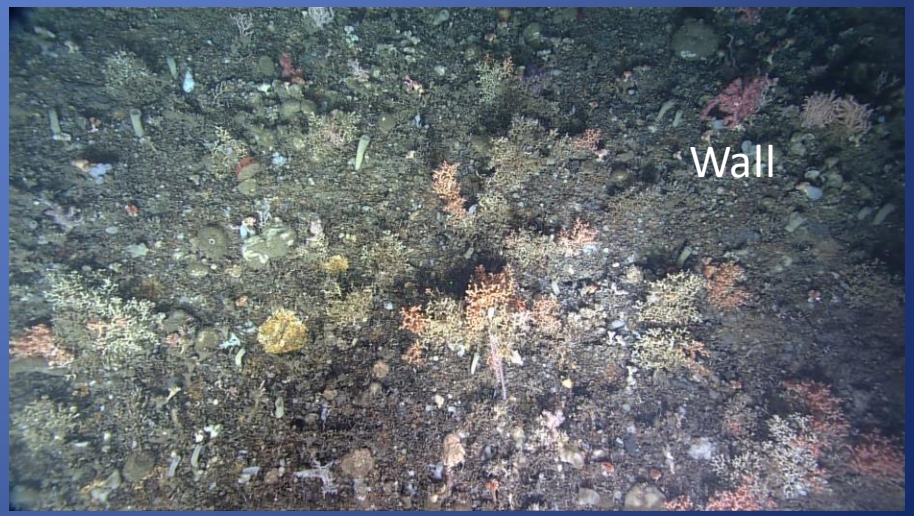
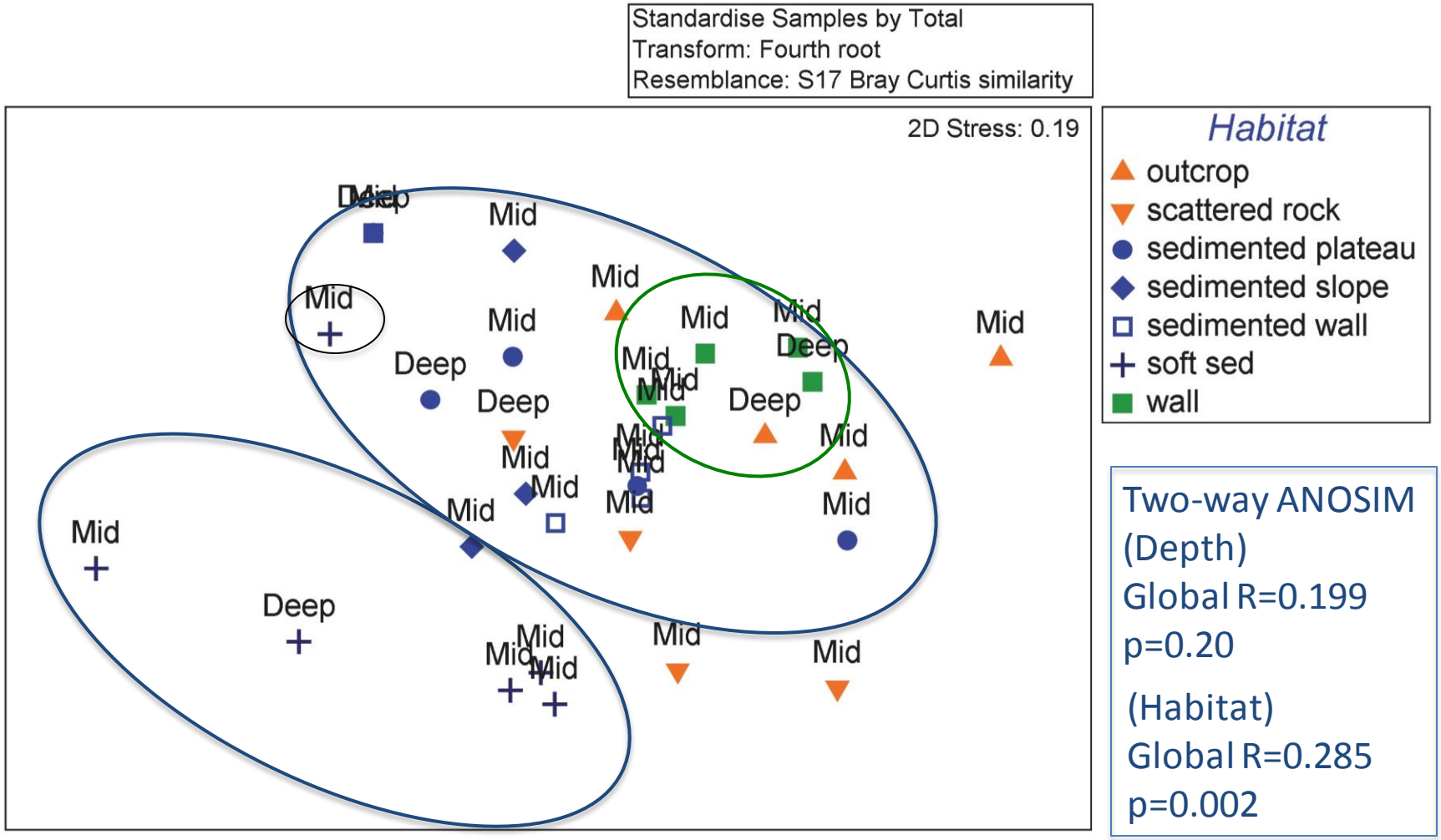


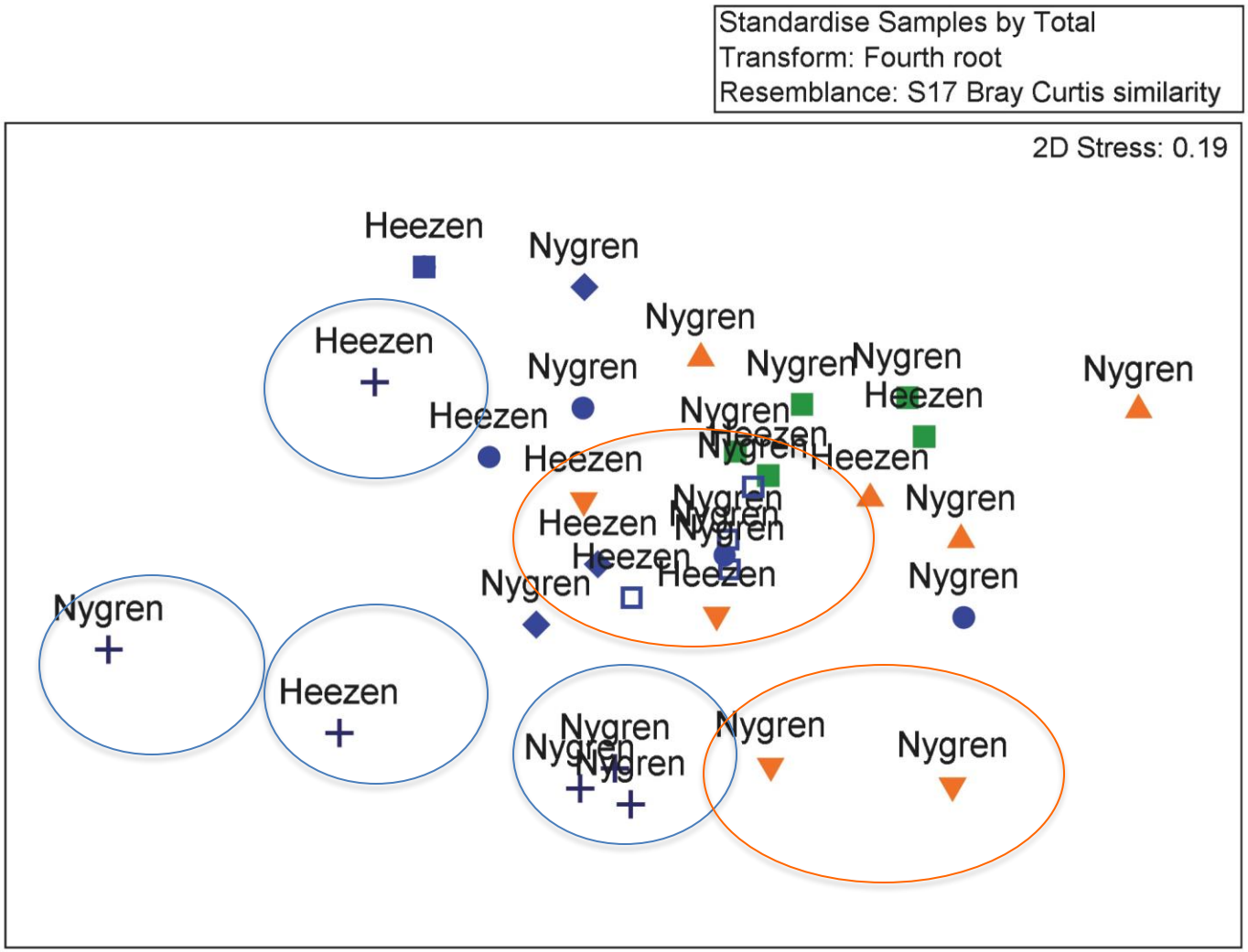




Coral Assemblages Differ Among Habitats within Mid/Deep Sites



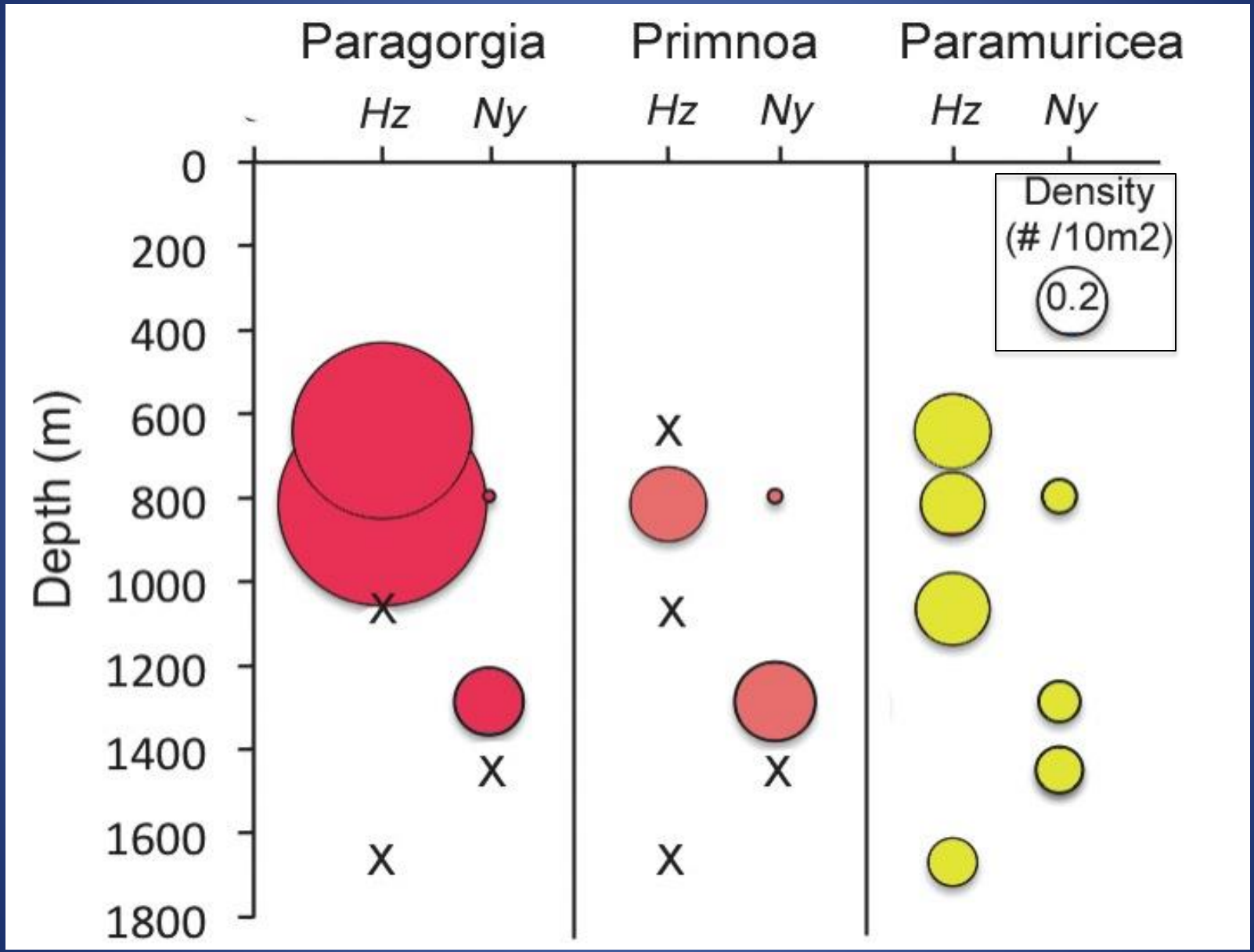
Some Differences in Assemblages Between Canyons



Two-way ANOSIM
(Canyon)
Global R=0.29
p=0.048

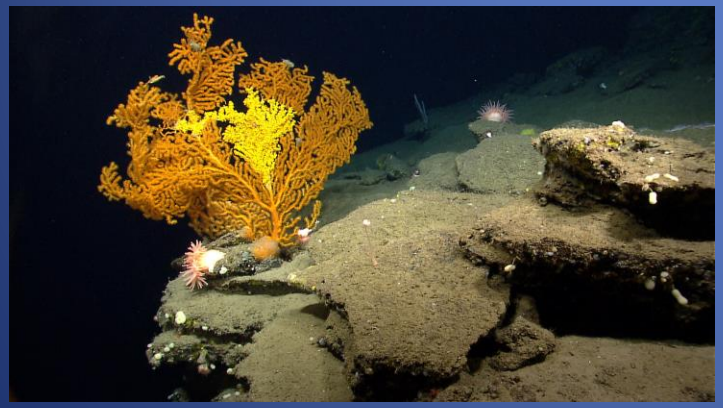
(Habitat)
Global R=0.39
p=0.002

Coral Abundance by Canyon Comparison



Conclusions

- Coral assemblages are influenced by depth
- Coral assemblages are influenced by habitat diversity
- Species richness of corals peak around 1300-1500 m and decline with deeper depths



Nygren Canyon

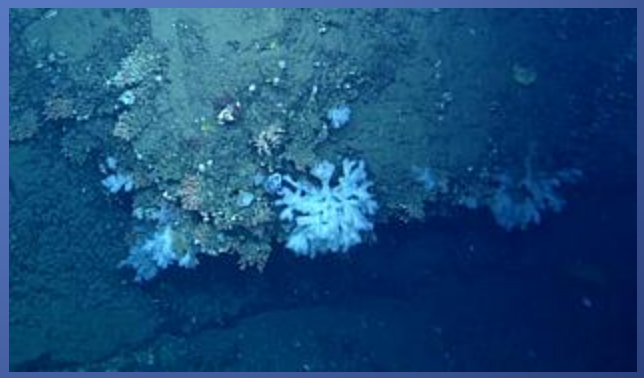
Heezen Canyon

Conclusions: Canyon Comparisons

- Differences apparent between Nygren and Heezen canyons
  - Diversity
  - Abundances
  - Habitat diversity
  - Geology
- Canyons in close geographic proximity have their own biological/geological signature
- Conservation efforts intended to protect coral resources need to incorporate information from each canyon under consideration

Next Steps

- More detailed analyses
  - Incorporating more depth strata
  - Improved species identifications
- Assess correlation between habitat diversity (substrate type), depth, latitude with coral occurrence, diversity, and abundance



Acknowledgments

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